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THE MEDITERRANEAN FRUIT FLY

A Round Table Talk before the Florida Entomological Society on April 26

By P. H. ROLFS
Consultor Technico de Agricultura for the State of Minas Geraes (Brazil)

I am very much surprised and delighted to meet so many of my friends here today, and equally pleased to see so many new people interested in this entomological problem. Having lived eight years among the pest, it is more than probable that I can give you a close view of this miserable and noxious insect. It may be pardonable to state for the benefit of the younger people here that for nearly eight years (1891-1899) I held the responsible position of Entomologist and Botanist to the Florida Experiment Station. (It takes a score of men to hold down that job now.) Among the pleasant recollections of that time was the discovery that the red-headed fungus is the most efficient agent for the destruction of the San José Scale. Later it was discovered that it was equally efficient in controlling some of the serious scale insects of citrus trees.

In the last two weeks scientists and others have asked me if I thought it possible to "control" the Mediterranean Fruit Fly. I have invariably replied, "Florida does not want control. Florida wants and will have nothing short of eradication."

Let us see, briefly, how these two systems work out in actual practice. Germany has, and has had for decades, a disease of livestock known as foot-and-mouth disease. She also had Dr. Loeffler, one of the great scientists of the ages. Germans are noted the world over as a scientific and practical people. Decades ago Germany entrusted Loeffler with the task of ridding her of foot-and-mouth disease. The Germans being an ultra practical people could not or would not permit the destruction of cattle that could be cured of the disease and later used for beef. The result is that after decades of struggle at control, Germany still has plenty of foot-and-mouth disease.

In 1914 this disease broke out in a herd of hogs at Niles, Michigan (arriving from goodness only knows where) and spread to the adjoining state of Illinois. Later it broke out among animals that had been on exhibition at the International Live Stock Show. Every farm and community where there were suspected animals was quarantined. Every animal in an infected herd was shot and buried deeply with quick lime. Even if there was only one animal in the herd infected, all were sacrificed. The work was done under guidance and direction of Dr. John Mohler, a scientist of high order and a man of broad economic vision.

It was drastic eradication but it was effective. And this was the result. The United States has eradicated outbreaks of the foot-and-mouth disease four times at an approximate cost of ten million dollars. In 1913 Germany was paying a tribute of about forty million dollars annually to control this same disease. Germany had a livestock population of only half that of the United States and an area a little larger than that of Texas. You can imagine what a stupendous tribute the United States would have to pay to the foot-and-mouth disease if we had been contented with control.

To make eradication possible we must have,—1", a basis of sound scientific facts; 2", an effective and vigorous propaganda; 3", an overpowering popular approval. With any one of these elements wanting or weak the work will be retarded or rendered inefficient.

THE FRUIT FLY OBSERVATIONS

I shall not attempt to review the literature written on this pest. Doubtless most or all present know its life history. What I want to do here is merely to record some observations during my eight years residence in Brasil.

In the State of Minas Geraes the coffee tree is almost omnipresent. Almost every back yard has one or more and every fazenda has from a few trees to large orchards. The ripe berry is a favorite host of the fruit fly. The sweetish pulp surrounding the ripe seeds is very attractive to them. After the berries have been picked they are taken to the large "terreiros" (coffee drying ground) or "barbacues" as they are called in many English speaking colonies. When the berries are sufficiently dried they are taken to the mill for hulling. After the berries have been removed from the "terreiros" it is possible at times to sweep up liters of pupae of the fruit fly. They do no per-

ceptible damage to the coffee berries so there is no reason why control or eradication measures should be taken.

At Anna Florencia there is a large coffee fazenda that we have visited many times. Along one side of the "terreiro" is a fine seedling citrus orchard about fifteen years old, composed of bitter sweet, Parson Brown group, midseason orange group, rangpur limes and others. We have eaten quantities of fruit from this orchard and have never found a maggot. This is a good illustration of the immunity of the immature citrus fruit. Along side of and among the citrus trees the whole range of truck crops are grown during twelve months of the year. This truck is rarely affected. This freedom from attack of the citrus fruits and truck crop is entirely due to the strict clean-up that is practiced in the grove and garden.

On the same fazenda, and less than a mile from the first one, is another grove and garden with which I am familiar also. In this place no care is taken to make a clean-up of the old fruit and surplus vegetables. Here the fly got all the grapefruit last year, many of the oranges, all of the loquats and peaches. The first locality gets an annual introduction of thousands if not millions of the fruit fly larvae with each coffee harvest and remains nearly unharmed. The latter place gets no new infestation but has a constant food supply for the pest, and so it practically ruins both the fruits and vegetables. In our part of Minas Geraes the pest could not persist on coffee alone. Very few coffee berries ripen between seasons to tide it over from one crop to the next.

ON THE COLLEGE GROUNDS

Here we may take up some observations of the pest on the grounds of the Agricultural College of the State of Minas Geraes. The region was apparently infested before we arrived. If it had not been it would have been introduced with the coffee hulls that we have hauled in for fertilizer. None of the records are with me so the percentage can be given only as an approximation and "no infestation" pertains only to my observation there.

Citrus Fruits. Kumquats,—Niewa, 100% drops before fully colored. *Tangelo,*—Thornton, 100% drops before at its best. *Grapefruit,* Marsh, Foster, Duncan, McCarty, 80% (plus or minus) drops by time they reached prime condition. *Shaddock,*—Melon, pyriform and Paradise, 60% (plus or minus)

before fully mature. *Round Oranges,*—30 or 40 varieties, no infestation until over mature, then considerable, probably 30% in some varieties. *Tangerines,*—Dancy and a seedling variety, dried up on trees without infestation. *Satsuma,*—Owari, no infestation. *Lemons,*—Genova and seedlings, also sweet lemons, no infestation. *Limes,* Mexican, other types, as well as sweet limes, no infestation. Bergamot orange, no infestation.

Peaches, many varieties, 100% infestation. Trees sprayed with poison bait showed a reduction of infestation coordinate with the spraying. The experiment shows some possibilities. Infestations begin when the fruits are about half grown. Fruits rarely reach maturity before dropping.

Plums, Japanese varieties, quite generally infested.

Surinam Cherries, dry season crop almost 100% infestation, rainy season crop, difficult to find an infested fruit. (Further discussion on this later.)

Apples, infestation begins when fruits are about two-thirds grown but fruit remains on the tree.

Guavas, common table and jelly varieties, carry the infection from season to season as there are nearly always fruits maturing thruout the year.

Mangoes, seedlings, less than one percent infestation.

The following fruits although fully exposed remained without infestation,—Japanese persimmon (kaki), pears (Asiatic), avocado, Carissa grandiflora.

INFLUENCE OF RAINS

In Minas Geraes as in Florida the rainy season is coincident with summer, tho in Minas the demarcation is much more accentuated. The winter is likely to pass without any rainfall. The total annual rainfall at Viçosa is the same as at Tampa.

The Surinam cherry ripens one crop toward the end of the dry season. When the last of this crop ripens the infestation is generally about complete. A second crop ripens well into the rainy season from blooms produced after the rains begin. The fruits are much larger but not so abundant as the dry season crop. In the second crop the infestation nearly reaches the zero point. (Difficult to find one.)

I have given these observations in a somewhat detailed way because they show something of the influence of the rains on keeping down the pest.

This appears to be a clue as to why *Ceratitis capitata* has apparently disappeared from certain localities in Brasil where it has been previously observed. It also gives a clue for its absence from grapes grown in favorite localities.

EMERGENCE FROM GRAPEFRUIT

During the last two years I have had all the drops gathered every morning from all of the citrus trees. Records have been made for each tree and all the fruit placed on the tables for my personal inspection. During this work I noticed that many larvae left the fruit between the time of placing it on the table and the examination of the fruit. The number that had emerged were counted. Several times when the fruit was left 24 hours on the table the number that emerged would approximate fifty percent of the affectation. This observation is rather important in a "clean up" program, as it shows what a very large proportion of the larvae leave the grapefruit during the first 24 hours after dropping. Some of the larvae pupated within a few hours after emergence and a very few remained active for three days. Apparently they do not all emerge in the same stage of development. After emerging they wriggle off to a dark place for transformation.

I have not encountered a pupa inside of a grapefruit but have found them inside of shaddock. A large proportion of the fruits dropped as the result of one infestation, but larvae in various sizes may be found in the same fruit. The foregoing observations show the importance of great precaution in moving and disposing of grapefruit that is affected.

THE FLORIDA SITUATION

"We have got the fruit fly." It has not got us by a long ways. The question is one of eradication. We cannot stop to investigate, to experiment, to deliberate. In my introductory remarks I told you what happened when people tried to be economical and conserve beef by *curing* cattle of foot-and-mouth disease. By "controlling" the disease they lost a million pounds for every one saved. Dr. Mohler had thousands of animals shot and buried with quick lime for no other reason than that they occurred on the same farm where only one other animal had the dreaded disease. Some of the perfectly healthy animals sacrificed were top-notch milkers,—the finest in the world, and worth tens-of-thousands of dollars. The sacrifice was heart-rending and enormous but it has already paid a thousand fold.

In fighting the Mediterranean fruit fly, the problem is not so

vast nor so complicated. The foot-and-mouth disease is transmitted by a virus; an infinitely small quantity of which is sufficient to cause infestation. Roving dogs, prowling around at night time, carried it from the quarantined farms to the free area. Crows alighting on infested premises carried on their feet an infinitesimal particle for miles into the free zone.

In the case of citrus canker, mockers and other birds carried the bacterium from an infested tree to adjoining properties. Bees and other insects were also capable culprits.

To eradicate the fruit fly, as indicated previously in this discourse, three basic conditions must be present, first, a basis in sound scientific knowledge; second, an effective and vigorous propaganda; third, an over-powering popular approval.

The first condition is an eminently satisfactory state. Thanks to the scientific entomologists who have labored year after year, often amid squalid surroundings in foreign countries. Frequently they have spent their own miserly salaries, without any expectation of popular approval, with no other end in view than to extend the horizon of scientific knowledge. I take my hat off to these earnest plodders. They have made it possible for us in Florida to stand today with our feet firmly on the solid rock of scientific facts, although we would not be able to name a half a dozen of these men.

The second condition, that of an effective and vigorous propaganda, has been waged for at least a decade. The pest has been all but over the border repeatedly in the last ten years. The menace of its introduction has been constantly before us. There is not a horticulturist in Florida who has been without this knowledge. Everybody has known that there is not a man, woman or child living in the state but would be poorer if ever the pest became established in the state.

The third point, an overwhelming popular approval, is clearly evidenced. Every branch of the government is squarely behind this eradication program. The fact that Wilmon Newell so ably conducted the canker eradication program has given the federal government and the state government complete confidence in his ability to handle the present situation. It needs generalship of the highest order and a concerted and concentrated action. After the allied powers made Foch generalissimo, the European conflagration soon terminated. It is the duty of every Floridian to give whole-heartedly his sympathy and loyalty to this eradication program.

The

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THE MEDITERRANEAN FRUIT FLY

The outstanding entomological event since the publication of our last number was the discovery early in April of the Mediterranean fruit fly in Florida. Infestations have been found from Brevard County on the East Coast to Pinellas County on the Gulf Coast, and north to Jacksonville. Except in the district about Orlando and extending as far north as Mt. Dora and the middle section of the East Coast, the infestations are light and apparently very recent. Every effort is being made to stamp out the pest and its numbers have materially decreased in the Orlando section.

In this issue we print a paper by Professor Rolfs in which he gives his experience with the fly in Brazil. As stated by Professor Rolfs, the fly behaves differently under different environments, so it is not surprising that some of his observations as to hosts vary somewhat from those of other observers in other parts of the world.

MARCH MEETING OF THE FLORIDA ENTOMOLOGICAL SOCIETY

The Society met in the Agricultural Building of the University on March 28, with President Grossman in the chair and fourteen members (including Mr. C. O. Bare of Sanford) and five visitors present. The address of the evening was by Mr. D. B. Mackie, Senior Entomologist of the Department of Entomology of California, on his work in the eradication of the citrus whitefly in California. A two percent oil emulsion is being used and the infestation at Oroville has been reduced from an average of 38 larvae to the leaf in 1925 to 2 or 3 per 1000 leaves in 1928.

H. E. BRATLEY, Secretary.

BIOLOGY OF THE MEXICAN COTTON BOLL WEEVIL

III. The Mechanism of Grub Feeding.

By EDGAR F. GROSSMAN[1]

The fact that the Mexican Cotton Boll Weevil grub *(Anthonomus grandis* Boh.) does not eat its way out of cotton fruit, has been viewed either with wonder, or with an acknowledgment of a self-preserving action of another (an ever growing series) mysterious instinct. The mental activities of those who pause to "wonder" is not of present interest. The instinct theory, however, at least offers an idea which can be adopted or refuted. It is very easy, at least mentally so, to introduce an instinct which confines the grub to the interior of the square. Self-preservation demands such an instinct because the grub, if once exposed to the exterior, would be subjected both to the ravages of bacterial or fungoid diseases, and the taste of numerous predators. Altogether a pretty idea, but this particular phenomenon can be traced at least one step farther back in our effort to gain the ultimate explanation of natural phenomena.

In this particular case explanation by instinct is discarded by the writer. The grub does not eat its way out of the cotton square because the outer shell is harder than the contents. The grub has a sufficient quantity of soft food to eat and therefore does not chew on the harder shell—thereby mechanically avoiding exposure to the exterior.

Introduce abnormal conditions. If the grub reacts "differently" and escapes it "loses its instinct of imprisonment," ergo, there was no instinct (or a new protective instinct may be mentally called into existence to supersede the failing instinct!). If the grub reacts "normally" with respect to changed mechanical conditions, and escapes from its cell, the "instinct" fails also.

Experimentally two artificial conditions were designed in which numerous grubs ate their way out of cotton fruit. One condition was that in which the outer shell was softened by placing the cotton fruit on trays in desiccators containing about 100 cc. water. By the time the floral envelopes were nearly as soft as the contents, some grubs started to chew through the walls. Likewise on drying cotton fruit until the inner contents were

[1]Contribution from the Department of Cotton Investigations, Florida Agricultural Experiment Station.

as hard as the shells, some grubs started to chew through the walls.

The relative hardness of the outer material and softness of the inner material was determined by measuring the resistance of the materials to a standard needle puncture. The average resistance in grams of the three classes of squares used follows:

	Outer Material	Inner Material	Difference
Normal cotton squares	11	3	8
Softened cotton squares	2½	1½	1
Hardened cotton squares	16	14	2

Experimental evidence then indicates that when there is little distinction between soft and hard material, i.e., when all the material is soft or when all is hard, the grubs, feeding "normally" meet no mechanical differentiation and consequently some individuals chew their way out of their protective cells. On the other hand, when there is a different degree of hardness between the shell and inner material of the square the grub does not bore its way out.

THE SCARABAEIDAE OF FLORIDA

By W. S. BLATCHLEY

Dunedin, Florida

(Continued from Vol. XII, No. 4,—p. 65)

e. Form stout, robust; front coxae transverse, not prominent; ventral segments connate. Genera XXVII-XXVIII. Tribe MELOLONTHINI.

ee. Form elongate, slender; front coxae prominent, conical; ventral segments not connate; color greenish or dull yellow, often iridescent; length 9-12 mm. Genera XXIX-XXX. Tribe MACRODACTYLINI.

aa. Hind tarsi with but one claw; tarsi without an onychium; hind tibiae with one spur or none; upper surface more or less thickly clothed with flat scales. Genus XXXI. Tribe HOPLIINI.

Genus XXIV. SERICA MacLeay

Oblong, convex insects of a brownish color, often iridescent and usually clothed with soft silken pubescence. They have the labrum united with and concealed by the clypeus; elytra feebly striate; ventral segments 6, not connate; hind coxae flat, broadly dilated; middle and hind tibiae with two spurs. They hide by day beneath leaves, logs and bark in orchards and woodlands.

85. (13354). **S. vespertina** (Gyll.).

Length 8.5-11 mm. Dark chestnut-brown, shining, not iridescent; clypeus with a deep acute notch each side, the margin in front of notch strongly reflexed; front of head and clypeus coarsely, confluently punctate, with wrinkles between the punctures.

Haulover and Tampa, "rare in February and April" (Sz.). Gainesville, March 10, eating foliage of young hickory (Doz.). Tallahassee, April 24 (Daw.).

86. (13361). **S. iricolor** (Say).

Length 5.5-6 mm. Blackish-brown, iridescent; clypeus emarginate at tip, without notch on side; head and thorax with numerous short, erect yellowish hairs.

St. Augustine (Ham.). Key West (Daw.).

*87. (13364). **S. sericea** (Ill.).

Length 8-9.5 mm. Purplish brown, strongly iridescent; clypeus without notch, rather finely and sparsely punctate; head and thorax not distinctly hairy.

"Fla." and Lake City (Daw.); Slosson Coll. (Leng); Gainesville, Feb. 21 (Bl.). A common species in the northern states, but probably occurs only in the northern third of Florida.

88. (———). **S. aspera** Dawson, 1922, 161.

Length 7-7.5 mm. Pale reddish to chestnut-brown, velvety and opaque, feebly iridescent. Allied to *parallela* Csy. Distinguished only by male genital organs.

Paratype from Marion Co., Fla.; Tallahassee, April 23, collected by T. H. Hubbell (Daw.).

89. (———). **S. delicata** Dawson, 1922, 161.

Length 7.5 mm. Amber brown, opaque, slightly iridescent; clypeal notch obsolete; clypeus evenly and closely punctate; elytra with line-like striae, each with a regular row of small punctures.

"Florida" (Horn Coll.); Green Cove Spring and New River (Leng Coll.); Lakeland and Haulover (Daw.).

90. (———). **S. tantula** Dawson, 1922. 162.

"Very similar to *delicata;* eyes smaller, antennal club slightly shorter, elytral striae less defined, their punctures irregular; claspers of male radically different" (Dawson).

Type from Lake Worth, Fla. No other record.

91. (———). **S. pusilla** Dawson, 1922, 162.

Very similar to the two preceding. "Elytra with a stronger iridescent sheen, their line-like striae punctured as in *delicata;*" male genital armature distinctive.

Marion Co. and Gulfport (Fall Coll.). Tampa, April 15 (Daw.).

92. (———). **S. lecontei** Dawson.

Length 9.5 mm. Pale to dark chestnut; polished, shining; clypeus nearly flat, rather strongly, closely punctate, margins reflexed and with a narrow acute notch each side; elytra rather strongly grooved, the furrows each with three confused rows of coarse, close-set punctures.

Tallahassee, April 23, collected by T. H. Hubbell (Daw.). Widely distributed over the eastern United States.

93. (———). **S. spicula** Dawson.

Length 7.5 mm. Claret-brown to chestnut, bare, polished and shining; clypeus feebly depressed, finely punctate, its center with a median tumidity, front margin separated from the lateral ones by deep, acute incisures; elytral sulci each with two confused rows of punctures.

Monticello, March 21, April 4, collected by W. A. Hoffman (Daw.). Known elsewhere only from Macon, Georgia.

*94. (———). **S. errans** sp. nov.

Length 6.5-7.5 mm. Pale reddish-brown, very feebly iridescent, wholly glabrous above, very sparsely pubescent beneath; clypeus concave, subquadrate, coarsely irregularly punctate, margin without notch, front one strongly reflexed, almost squarely truncate; front similarly punctate, occiput smooth. Thorax with middle distinctly more convex than sides, basal margin strongly bisinuate, disk evenly, rather sparsely and finely ocellate-punctate. Elytral intervals distinctly convex, irregularly sparsely punctate; striae each with a regular row of rather coarse close-set serrate punctures. Metasterna and hind coxal plates finely sparsely evenly punctate; ventrals coarsely irregularly so. Antennal club of male very large, one-third or more longer than remaining segments united.

Dunedin, Dec. 10-April 19; three males, two females, three at porch light, the others beaten from bunches of Spanish moss. Ocala, April 17 (L. H. Weld). Specimens were sent to R. W. Dawson, who pronounced it a very distinctive new species.

Genus XXV. HYPOTRICHIA LeConte.

Elongate-oval species, densely white pubescent beneath and having the antennae 10-jointed; labrum distinct; front coxae conical, prominent; hind femora much thickened; ventral segments six.

*95. (13374). **H. spissipes** Lec.

Length 11-13 mm. Piceous-brown; thorax finely and deeply punctate, thickly clothed with fine prostrate hairs; elytra similarly punctate, the hairs brown.

Crescent City, June 23, emerging from the ground in pine woods (Hubb.); St. Augustine (Ham.); Enterprise (Dietz); Gulfport (Fall). Dunedin, June 5, at porch light. Known only from Florida.

Genus XXVI. DIPLOTAXIS Kirby.

Small or medium, oblong or ovate, convex, brown or blackish beetles, having the antennae 10-jointed; apical margin of thorax membranous; elytra usually not striate but with the rows of punctures alternately approximate, the wider intervals irregularly punctate; visible ventral segments five; front coxae prominent, conical; tarsal claws cleft or toothed. Like other members of the family they are phytophagous, hiding by day beneath bark and stones, and flying about and to light at night. In his "Revision" Fall recognized 95 species from the United States, only seven of which are known from Florida. These are all glabrous species having the mentum horizontal, with its declivity margined by a raised line and a row of erect setae, and the thoracic angles not impressed.

*96. (13411). **D. subcostata** Blanch.

Length 9-11 mm. Dark reddish or chestnut-brown, shining; sides of thorax in this and *rufa* bisinuate; front of clypeus broadly rounded, sinuate at middle; elytra not alutaceous; pygidium coarsely punctate and with a shallow median longitudinal impression.

Cedar Keys, one specimen in June (Sz.); Jacksonville (C. & L.); Gainesville, Oct. 6, large numbers under arc light (Doz.); Lake City and Crescent City (Fall). The largest of our seven species.

97. (13412). **D. rufa** Linell, 1895, 725.

Length 8-9 mm. Reddish-brown; front of clypeus squarely truncate; elytra finely alutaceous; pygidium without median impression.

Described from Georgiana. Enterprise (Dietz); Useppa Island, Lee Co., April (Dav.).

*98. (13413). **D. frontalis** Lec.

Length 8-9.2 mm. Black or brownish-black, shining; front of clypeus rounded and sides of thorax not bisinuate in this and remaining species; front of head just behind clypeus with a transverse convex ridge, and a distinct median impression behind it; basal margin of thorax not impressed near hind angles.

Monticello (Sz. Ms.). Gainesville, April 6, at light; April 24, feeding at night on chinquepin foliage (Doz.). Lake City, May 6-June 2 (Ag. Coll.). Marion Co. (Fall).

99. (13414). **D. excavata** Lec.

Similar to *frontalis* except that the thoracic disk is broadly and deeply concave along basal margin near hind angles.

St. Augustine (Ham.); Enterprise (Dietz).

*100. (13453). **D. bidentata** Lec.

Length 6.2-7.7 mm. Ovate, strongly convex; black or chestnut-brown, strongly shining; base of thorax with a row of punctures, but without a marginal impressed line; head and thorax sparsely, coarsely punctate; upper tooth of front tibiae very small or wanting, much nearer the second tooth than the latter is to the apical one.

One of the most common Scarabs in Florida, occurring throughout the state. Attracted by thousands to light, March to June. Numbers taken at night, April 24, near Gainesville, feeding on chinquepin foliage (Doz.).

101. (13455). **D. harperi** Blanch.

Length 7-10 mm. Oblong; reddish-brown to blackish, strongly shining; base of thorax distinctly impressed along the margin; head and thorax densely, rather coarsely rugosely punctate.

A common northern species recorded from Florida only by Fall (1909, 80) without definite station record. Gainesville, Jan. 27 (Ag. Coll.).

*102. (13457). **D. languida** Lec., 1878, 403.

Length 5.8-6.8 mm. Elongate-oblong; head and thorax reddish-brown, elytra dull yellow; clypeal margin broadly rounded; head finely, closely punctate, thorax more coarsely unevenly and sparsely so.

Described from Tampa, where it was "common in April on oak trees at night" (Sz.). Occurs throughout the State, the records at hand being from eleven stations, including Jacksonville, St. Petersburg and Key Largo.

(To be continued)

APRIL MEETING OF THE FLORIDA ENTOMOLOGICAL SOCIETY

The Society met in the Agricultural Building on April 26, with Dr. Berger as the presiding officer and over sixty members and visitors present. The subject of the meeting was a round table discussion of the Mediterranean fruit fly. Dr. P. H. Rolfs, a charter member of the Society, gave the principal address of the meeting. He described the ravages of the pest in Brazil. An abstract of his talk is printed in this issue.

H. E. BRATLEY, Secretary.

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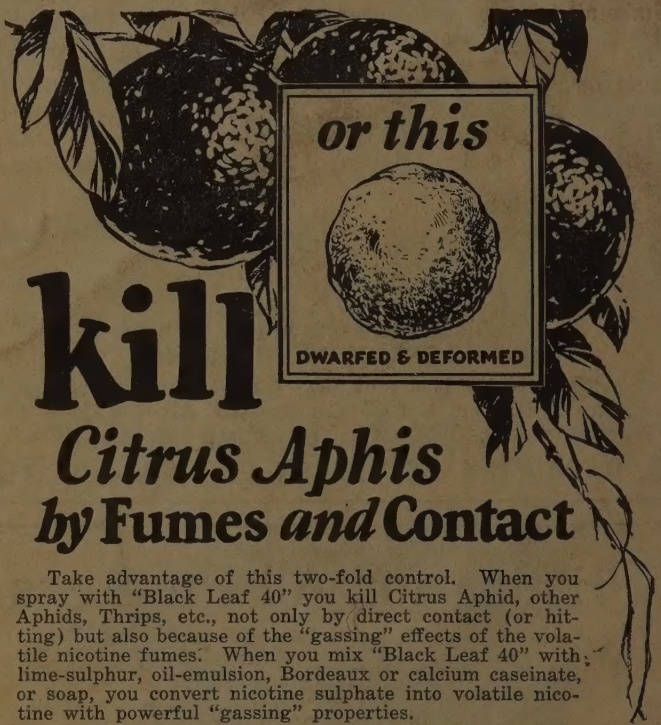

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